

Delays in the diagnosis and surgical treatment of lung cancer

J S Billing, F C Wells

Abstract

Background – Patients admitted for resection of lung tumours frequently experience lengthy delays in diagnosis and preoperative investigations. This study was conducted to quantify this delay between presentation and definitive treatment and to assess the factors responsible for such a delay.

Methods – All patients undergoing lung resection for a tumour at a single surgical unit in 1993 were studied. The date of each consultation, investigation, and referral was identified, and the extent of any delay determined.

Results – The mean total delay from presentation to operation was 109 days. Within this period an average of one month occurred before referral to a respiratory specialist who then spent two months investigating the patient. After referral to a surgeon, surgery took place within a mean interval of 24 days.

Conclusions – These delays to definitive treatment appear unacceptable. Points at which the efficiency of the diagnostic process could be improved are discussed. The length of delay did not correlate with tumour stage in this study.

(Thorax 1996;51:903-906)

Keywords: lung cancer, surgical resection, diagnostic delay.

Patients with lung neoplasms may present with symptoms of the primary tumour such as cough, haemoptysis or shortness of breath, or as a result of secondary spread such as bone pain. Alternatively, the tumour may first be detected as an incidental finding on a chest radiograph. Once an abnormality has been noticed on chest radiography, investigations are then directed towards confirming the diagnosis of carcinoma, establishing the cell type, and assessing the resectability of the tumour. If the tumour has spread directly to the chest wall or mediastinal structures, or has metastasised, it cannot be considered potentially curable by surgery. This involves bronchoscopy and biopsy, computed tomographic (CT) scanning, and often percutaneous needle biopsy. If suspicious mediastinal lymph nodes larger than 1 cm diameter are found on the CT scan, the patient will need further staging procedures to determine whether the tumour has metastasised to these nodes. The possible procedures are mediastinoscopy, anterior mediastinotomy, or thoracoscopy. Pulmonary function must

also be measured if resection of a lung malignancy is contemplated.

We had the subjective impression that many patients admitted for resection of their lung cancer had first presented several months previously. The numerous steps in diagnosis and preoperative staging inevitably entail some delay, but the delay seemed to be longer than necessary. The survival of patients with lung cancer is well known to be correlated with the stage.¹ Naturally there is concern that delay in diagnosis and treatment allows tumour progression and thus reduces survival. The patient may also require more extensive resection. This is in addition to the high levels of anxiety that any delay can generate in patients who realise that they have lung cancer which may require surgery.

This study was undertaken to assess the length and cause of delay from the first presentation to surgery and to identify the stages at which such delay occurs.

Methods

A retrospective study was made of all patients with lung tumours referred for lung resection at Papworth Hospital from 1 January 1993 to 31 December 1993. The names of the relevant patients were found from the operating theatre audit information. Data were obtained from medical records at the cardiothoracic regional centre and also at the referring hospitals. General practitioners and the departments of radiology and pathology were contacted for further details when required. The data collected were the dates on which each consultation, investigation and referral occurred, and the date of operation. The time of onset of symptoms was not recorded, since this would be very inaccurate in such a retrospective study and since it is not germane to the study. The tumour type and stage were also identified. From these data it was possible to identify the delay incurred by each patient at each stage in the investigative process. The hospital records for one patient were not available for this retrospective study, and this patient has therefore been excluded from the analysis.

The delays studied were: (1) from first presentation to chest radiography, and (2) to chest physician referral; (3) from chest physician referral to chest clinic appointment; delays for (4) bronchoscopy, (5) CT scanning and (6) percutaneous needle biopsy; (7) from chest physician referral to surgical referral; (8) from this referral to surgical outpatient appointment; (9) from surgical referral to operation; and (10) the total delay from presentation to

Department of
Cardiothoracic
Surgery,
Leeds General
Infirmary,
Leeds LS1 3EX, UK
J S Billing

Department of
Cardiothoracic
Surgery,
Papworth Hospital,
Papworth Everard,
Cambridge CB3 8RE,
UK
F C Wells

Correspondence to:
Mr J S Billing.

Received 14 December 1995
Returned to authors
12 March 1996
Revised version received
10 April 1996
Accepted for publication
11 April 1996

surgery. These intervals were identified for each patient. The mean length of each delay was then calculated, together with 95% confidence limits.

The TNM staging for each patient was available from the histopathology reports. The mean total delay for patients with stage I, II, III and IV tumours was then calculated, and the total delay for stage I tumours compared with that for more advanced lesions using the Student's *t* test. The mean total delays for symptomatic patients and those diagnosed incidentally were also analysed, and these two groups were similarly compared using the Student's *t* test.

Results

Thirty nine patients underwent surgery for lung tumours in 1993 at this institution. One of these has been excluded, as discussed above, and the delays affecting the remaining 38 have been analysed. The study group comprised 29 men and nine women, with a mean age of 61 years. These patients were referred by chest physicians at six different hospitals in the region, and the spectrum of delays at each centre was comparable.

The delays incurred at each stage in the investigative process are detailed in table 1 as the mean delay and 95% confidence limits. The mean total delay from first presentation to definitive surgery was 109 days, with a range of 14–245 days. The time of presentation was taken as the first general practitioner consultation for symptomatic patients or the date of chest radiography for those eight patients (21%) whose tumours were discovered incidentally. The delay from presentation to chest radiography naturally refers only to symptomatic patients. Twenty nine patients underwent fiberoptic bronchoscopy and in 15 it yielded a positive diagnosis. Percutaneous needle biopsy was performed in 19 patients, with 15 giving a positive result. Thus, most of the patients were referred with a tissue diagnosis. It is worthy of note that only 11 patients (29%) were seen in the surgical outpatient clinic, the remainder being admitted directly for surgery after a referral had been received.

Table 1 Delays at each stage of diagnosis and investigation

Delays from	Mean (days)	95% confidence interval (days)
Presentation to surgery	109	92 to 127
Presentation to chest physician referral	32	21 to 42
Presentation to chest radiography	26	14 to 38
Chest radiography to chest physician referral	15	8 to 21
Chest physician referral to surgical referral	58	45 to 71
Chest physician referral to consultation	15	11 to 19
Fiberoptic bronchoscopy	14	6 to 21
CT scanning	18	13 to 23
Percutaneous needle biopsy	15	10 to 20
Surgical referral to operation	24	19 to 30
Surgical referral to consultation	10	4 to 16
Staging by mediastinoscopy	20	11 to 29

Table 2 Cell types and stages of resected carcinomas

Cell type	Pathological stage	No of patients
Squamous carcinoma	I	13
	II	2
	III	3
Adenocarcinoma	I	3
	II	2
	III	5
Undifferentiated carcinoma	III	2
Adenosquamous carcinoma	I	1
Small cell carcinoma	I	1

Only three patients (8%) required mediastinoscopy for staging by biopsy of mediastinal lymph nodes.

Thirty patients underwent lobectomy, seven required pneumonectomy, and in one case the tumour proved unresectable. After histological examination of the resected specimen and removed lymph nodes 18 patients (47%) were found to have stage I carcinoma, four (11%) had stage II tumours, 10 (26%) had stage III tumours, and one patient had a stage IV tumour. The remaining five patients were not amenable to this staging, one having a pulmonary angiosarcoma and the others benign lesions. These patients did, however, undergo the same process of preoperative investigations. The cell types and pathological stages of the resected carcinomas are detailed in table 2.

The mean total delays corresponding to tumour stage at the time of surgery were 119 days (95% confidence limits 73 to 165 days) for stage I, 123 days (94 to 152) for stage II, 92 days (63 to 121) for stage III, and 93 days for stage IV tumours. These differences were not statistically significant. Of the 18 patients with stage I disease only one patient has died, from septicaemia following postoperative aspiration, and only one patient has had recurrence of tumour. By contrast, five out of 10 patients with stage III and IV disease have died from their malignancy and one further patient has recurrent disease.

The mean total delay for symptomatic patients was 119 days (95% confidence limits 100 to 138 days), while for those diagnosed incidentally it was 71 days (34 to 108), a statistically significant difference ($0.02 < p < 0.05$). However, the incidentally diagnosed patients did not have an earlier stage at operation: five stage I and three stage III carcinomas compared with 13 stage I, four stage II, seven stage III, and one stage IV in the symptomatic group. Not surprisingly, these two groups have so far had similar outcomes with three deaths in each group.

Discussion

Surgical resection remains the treatment of choice for non-small cell carcinoma of the lung.^{2,3} This modality offers the best prospect of cure and better overall survival rates than other forms of treatment. However, surgery is limited by the resectability of tumours and success depends upon early diagnosis and intervention while the tumour remains local-

ised. The therapeutic aim is to diagnose tumours while in stage I and treat them by surgical resection. Studies of lung cancer screening have shown that 70–80% of men with stage I lung cancer treated by resection do not die of their malignancy, whereas symptomatic lung cancer overall is more than 90% fatal.⁴

In this context, any delays incurred in the diagnosis and preoperative staging of lung cancer once it has presented are highly undesirable. These results have shown that the average delay from presentation to surgery is between three and four months. Of this period, there is on average one month spent before specialist referral and almost two months spent being investigated by a chest physician. This latter period of delay can be attributed as follows: two weeks waiting for an outpatient consultation and two weeks waiting for each investigation such as bronchoscopy, CT scanning, and percutaneous needle biopsy. The mean time from being referred to a thoracic surgeon to the date of pulmonary resection is then 3–4 weeks. The main delay after surgical referral is the requirement for surgical staging to exclude mediastinal lymph node metastases and hence establish the appropriateness of resection before definitive surgery can be planned. Most patients were not seen preoperatively in surgical outpatients since that would have added a further delay. The details of surgery were discussed with patients at the time of admission. The relatively small number of resections for the size of the unit during the year under study helped to keep the surgical delay to an absolute minimum.

These results highlight the need for a high index of suspicion among general practitioners, with a low threshold for early referral, especially for patients at particular risk of developing lung cancer such as long term smokers who present with new chest symptoms. Much of the remaining delay appears to arise while patients are undergoing multiple investigations, each requiring a separate hospital visit. The efficiency of this system could be greatly improved if the investigations were centralised in specialist lung cancer centres, in accordance with proposals from the Department of Health.⁵ Patients with a suspected diagnosis of lung cancer could be admitted for a short stay of 1–2 days during which all of the diagnostic and staging investigations could be performed. Those for whom surgical resection was appropriate could then be readmitted shortly afterwards for their surgery. Either way, a significant increase in funding for this area of medical care would be needed to reduce delays.

Not surprisingly from the natural history of non-small cell lung cancer, the length of delay in this study did not correlate with tumour stage at the time of operation. As would be expected, however, the outcome was related to tumour stage, with only one recurrence in a patient with a stage I tumour. Although the sample size is small, these findings are in keeping with other published results.¹ Patients whose diagnosis resulted from an incidental finding on chest radiography did have a shorter

preoperative work-up, but this did not translate into any benefit in terms of tumour stage or survival.

Although this relatively small study does not contain data to demonstrate any survival advantage from shorter preoperative delays in terms of tumour stage, the aim of reducing delay remains important. A larger prospective study of all patients presenting to chest physicians with symptoms suggestive of lung cancer may go further towards demonstrating the importance of shorter delays. Nonetheless, a delay of three or four months from the time of presentation to definitive treatment cannot be acceptable from the point of view of the patient, whose life is completely disrupted by the process of attending multiple hospital appointments for outpatient clinics and separate investigations.

There are no published British studies of delays in the diagnosis and treatment of lung cancer. The problem has been investigated in Brazil, however, where two prospective studies looked at delays in the diagnosis of lung cancer from the onset of symptoms.^{6,7} The time from the first consultation to diagnosis was more than 90 days in over 50% of patients. Average delays for bronchoscopy and needle biopsy were 20 and 10 days, respectively. These figures are similar to those reported here. The Brazilian authors attributed the delay to inadequacy of medical services, and delays in referrals and performance of subsidiary tests. Regrettably, some of the same reasons appear to pertain in Britain.

There have been previous studies of the relationship between diagnostic delay and cancer survival for several tumour sites including the lung.^{8,9} Interestingly, the former study defined a delay in diagnosis as an interval of more than six weeks from the onset of symptoms to diagnosis. Neither study found a clear relationship between diagnostic delay and tumour stage. However, the survival rate was higher in patients in whom the disease was diagnosed earlier.⁸

Another aspect of diagnostic delay is whether it can be considered negligent. In the United States delayed diagnosis of cancer is a frequent cause of litigation for diagnostic errors. For a delay of less than three months jury verdicts tend to favour the defence, but a delay in diagnosis of six months has generally been viewed as the threshold for negligence.¹⁰

Even if all diagnostic delay could be eliminated, the symptoms for lung cancer occur relatively late in its course and many patients present with unresectable tumours. Since carcinoma of the lung is the most common malignant disease in Western Europe, and curative surgery is only possible for non-small cell carcinomas detected at an early stage, perhaps more attention should be directed towards possible screening methods. Cigarette smokers above a certain age represent a very important risk group on whom screening could be targeted. A study in New York used annual screening by chest radiography combined with sputum cytology.¹¹ By this means, 40% of lung cancers were diagnosed in

stage I. For stage I disease the five year survival from time of detection was 76%, and the overall five year survival in the screened population was 35%. This contrasts with symptomatic lung cancer which is more than 90% fatal. In the New York study cytological examination of the sputum carried no further screening benefit in addition to annual chest radiography. Screening for lung cancer may not be an immediate prospect in the UK, but it should be feasible to improve the efficiency of investigation and diagnosis in order to reduce these delays.

The authors thank Dr Alan Price for his most helpful comments on the manuscript.

- 1 Melamed MR, Flehinger BJ, Zaman MB, Heelan RT, Hallerman ET, Martini N. Detection of true pathologic stage I lung cancer in a screening program and the effect on survival. *Cancer* 1981;47:1182-7.
- 2 Pearson FG. Current status of surgical resection for lung cancer. *Chest* 1994;106:337-9S.
- 3 Lederle FA, Niewoehner DE. Lung cancer surgery. A critical review of the evidence. *Arch Intern Med* 1994;154:2397-400.
- 4 Melamed MR, Flehinger BJ. Screening for lung cancer. *Chest* 1984;86:2-3.
- 5 Department of Health, Welsh Office. A policy framework for commissioning cancer services. A report of the Expert Advisory Group on Cancer to the Chief Medical Officers of England And Wales. London: Department of Health, 1995.
- 6 Pereira JR, Ikari FK, Minamoto H, Cassioli JC. Delay factors in the diagnosis of lung cancer: a public health problem. *Rev Paulista Med* 1991;109:109-12.
- 7 Silva PP, Pereira JR, Ikari FK, Minamoto H. Lung cancer and the delay in diagnosis: analysis of 300 cases. *Rev Assoc Med Bras* 1992;38:145-9.
- 8 Robinson E, Mohilever J, Zidan J, Sapir D. Delay in diagnosis of cancer. Possible effects on the stage of disease and survival. *Cancer* 1984;54:1454-60.
- 9 Porta M, Gallen M, Malats N, Planas J. Influence of "diagnostic delay" upon cancer survival: an analysis of five tumour sites. *J Epidemiol Community Health* 1991;45:225-30.
- 10 Kern KA. Medicolegal analysis of the delayed diagnosis of cancer in 338 cases in the United States. *Arch Surg* 1994;129:397-403.
- 11 Melamed MR, Flehinger BJ, Zaman MB, Heelan RT, Perchick WA, Martini N. Screening for early lung cancer. Results of the Memorial Sloan-Kettering Study in New York. *Chest* 1948;86:44-53.